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SPRUCE BUDWORM INFESTATIONS

FOREST SERVICE REGION 4

November 1962

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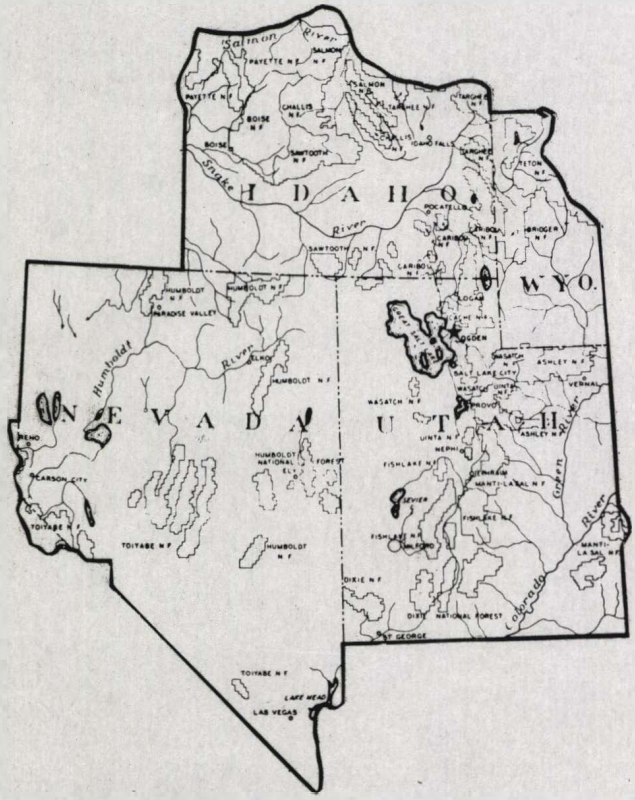

BRANCH OF FOREST INSECT AND DISEASE
PREVENTION AND CONTROL

DIVISION OF TIMBER MANAGEMENT

Forest Service
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Ogden, Utah

SPRUCE BUDWORM INFESTATION
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INTRODUCTION

The spruce budworm, Choristoneura fumiferana (Clem.), is a major pest of the Douglas-fir, Engelmann spruce, and true firs of the southern Idaho portion of U. S. Forest Service, Region Four. The present epidemic extends over parts of seven National Forests and has been developing since 1958. A previous epidemic, which covered some of the same area, developed from 1951 to 1954; and in 1954 a control program was initiated which carried through 1957. Altogether, 2,228,346 acres were sprayed. No control has been undertaken since 1958 and the budworm population has been building steadily since then.

A combination of air and ground techniques was used to gather data for evaluation of the present spruce budworm situation. Mapping the infestation boundaries and delineation of broad classes of current damage were accomplished by aerial surveys. The groundwork involved examinations of the early and late larvae populations, pupal case counts, and collections of egg mass density material. During each ground evaluation, current damage was measured. All egg and egg mass counts were made in the Region's laboratory at Ogden, Utah.

CURRENT CONDITIONS

The 1962 infestation covers a total of over 1.6 million acres. About 29% (480,000 acres) is classed as lightly defoliated, 23% (373,000 acres) is medium, and 48% (788,000 acres) is heavily defoliated. The following table gives a comparison of the acreages by damage classes from 1960 through 1962.

	Damage Class in Acres			
Date	Light	Medium	Heavy	Total
1960	297,000	80,000	19,000	396,000
1961	643,000	229,000	553,000	1,425,000
1962	480,000	373,000	788,000	1,641,000

In this report the three damage classes used refer only to current defoliation. The classes are defined by estimated percent of current foliage destroyed, and are as follows: Light - any defoliation visible from the air, usually between 20 and 50 percent. Medium - 50 to 75 percent defoliation. Heavy - over 75 percent defoliation.

In reality the present budworm epidemic involves three separate and distinct infestations. They are discussed in this report under the following headings: Salmon River infestation, Targhee National Forest infestation, and Sawtooth National Forest infestation.

Salmon River Infestation

The Salmon River infestation covers part of the Salmon, Challis, Payette, and Boise National Forests. It follows the main Salmon River from Arctic Creek in the Idaho Primitive Area, upriver nearly to the town of Challis, Idaho. In addition, the main side drainages (Middle Fork, Panther Creek, Lemhi River, and North Fork) are infested. Acreages by Forest and damage classes are given in the following table:

1962 Salmon River Infestation

National Forest	Light	Medium	Heavy	Total
Salmon	220,000	130,000	579,000	929,000
Challis	150,000	74,000	73,000	297,000
Payette	52,000	34,000	51,000	137,000
Boise	11,000	20,000	29,000	60,000
TOTAL	433,000	258,000	732,000	1,423,000

The 1962 infestation covers 1,423,000 acres. This is an increase of some 145,000 acres over last year. Significantly, the severity of damage also increased. The area of medium-damage increased from 153,000 acres to 258,000 acres. Heavy damage jumped from 508,000 acres to 732,000 acres. Further comparisons show 52 percent of the 1961 infestation was classed as medium (12 percent) and heavy (40 percent); whereas in 1962, 69 percent of the acreage is classed as medium (18 percent) and heavy (51 percent). Noticeable killing of reproduction occurred in 1962, and it is quite possible that many poles and mature trees will not survive the winter. On the basis of an evaluation of several factors, it appears the Salmon River infestation may enlarge slightly next year and the severity of damage will intensify. The following table contains egg mass survey data and predicted damage for 1963:

1962 Spruce Budworm Egg Mass Survey

Sample Area	1962 damage level	Average egg masses 1,000 square inch	Average egg/mass [1]	1963 [2] predicted damage level	Expected damage level
Porphyry Creek	> 90%	8	30.62	25-50	> 90%
Panther Creek	75-90%	24	24.47	90-100	75-90%
Twin Creek	> 90%	14	38.04	51-90	50-90%
Carmen Creek	> 90%	20	33.01	90-100	> 90%
Moccasin Creek	50-75%	2	14.84	< 15	50-75%
Dahlonega Creek	75-90%	28	29.82	90-100	> 90%
TOTAL AREA		14.46	30.00		

The predictions differ in two drainages from the damage level predicted by the egg mass counts. A standard number of branches were collected on all plots, but those collected in Porphyry Creek had been heavily defoliated for the last four years. Consequently, the area of foliage measured was less than believed necessary for full confidence in a prediction based on egg mass density.

In Porphyry Creek pupal cases averaged 5.9 per 15-inch twig, placing the area in Class IV, the highest population class used in Region Four. Expected damage based on pupal case counts would be in excess of 90 percent.

A mass adult flight migration occurred in and around the Porphyry Creek area which could have had a decided effect upon location of egg mass deposition. Nevertheless, considering all factors, a defoliation of greater than 90 percent next year is expected. At the same time it should be recognized that the prediction is not based entirely on measured data. *

For Moccasin Creek the egg mass survey data indicates less than 15 percent defoliation next year. Nevertheless, defoliation is expected to range between 50-75 percent next year. Much of the timber in the drainage is Engelmann spruce and true fir. Only Douglas-fir was sampled for the egg mass survey since damage prediction tables were not available for Engelmann spruce or fir species. For this reason more reliance was placed on the pupal case counts and interpretation of other biological data.

1/ James L. Bean, A Method for Estimating the Number of Spruce Budworm Eggs per Egg Mass, Journal of Economic Entomology, Vol. 54, No. 5, p. 1064. October 1961.

2/ V. M. Carolin and W. K. Coulter, Research Findings Relative to the Biological Evaluation of Spruce Budworm Infestations in Oregon, pp. 1 - 39. U. S. Dept. of Agriculture, Pacific Northwest Forest and Range Experiment Station - 1959.

Targhee National Forest Infestation

The main budworm infestation on the Targhee National Forest extends along the northern edge of the Forest from about the West Fork of Indian Creek (approximately 10 miles west of Spencer, Idaho) eastward around Henrys Lake and thence southward to Garner Canyon. Altogether, there are over 177,000 acres of visible defoliation of which 43,000 is classed as light, 105,000 as medium, and 29,000 as heavy. The following table shows acreages infested by damage classes for the last three years.

Year	Light	Medium	Heavy	Total
1960	97,000	30,000	4,000	131,000
1961	20,000	67,000	39,000	126,000
1962	43,000	105,000	29,000	177,000

The area showing visible budworm damage increased by 51,000 acres during the past year. The increase in acreage was mostly a general expansion of last year's boundaries. The exception is a new area of budworm buildup at the head of Medicine Lodge Creek some thirteen air miles west of the main infestation. Here two isolated spots totaling about 1,500 acres were heavily defoliated this year. Acreage in the light and medium class increased, but the area of heavy defoliation decreased. Last year heavy defoliation occurred in ten "hot spots" scattered throughout the infestation. Eight of these former "hot spots" were again heavily defoliated. Two dropped to the medium class but four new areas were noted where defoliation exceeded 75 percent.

Pupal case counts and egg mass density data were collected for use in predicting expected damage next year.

1962 Spruce Budworm Egg Mass Survey

Sample Area	1962 damage level	Average egg mass per 1,000 square inches	Average[1] eggs per mass	1963 [2] predicted damage level	Expected damage level
Twin Creek	50-75%	9	38.87	51-90%	75-90%
Targhee Creek	50-75%	7	39.07	25-50%	50-75%
Rattlesnake Creek	75-90%	32	33.11	> 90%	90%
Meyers Creek	75-90%	13	28.63	51.90%	75-90%
Stoddard Creek	75->90%	3	27.72	15%	15-25%
TOTAL AREA		13.68	33.40	51.90%	

1/ Ibid., p. 1064.

2/ Ibid., pp. 1-39.

It is expected that next year's defoliation will be close to the highs predicted by the egg mass survey. In Targhee Creek we feel the damage may go as high as 75 percent, primarily because of the large number of eggs per mass. In both Targhee and Twin Creeks, a majority of egg masses had three rows of eggs rather than two. In general, the pupal case numbers indicate slightly greater defoliation than the egg mass survey.

Sawtooth National Forest Infestation

The Sawtooth National Forest infestation is centered near the heads of Big and Little Smokey Creeks, and extends downstream along both sides of these drainages to the South Fork of the Boise River.

Last year, visible defoliation covered 13,000 acres; this year it increased to 41,000 acres. The breakdown of acreage by damage classes shows 27,000 as heavy, 10,000 in the medium class, and the remaining 4,000 acres lightly defoliated. In 1961 most of the infestation was south of Big Smokey Creek and along the upper end of Little Smokey Creek. Much of the present infestation is north of Big Smokey Creek and nearly all of the north side drainge is heavily defoliated.

Data collected from egg mass sample plots show this year's defoliation ranged from 25 to over 90 percent. On the basis of the egg mass survey, most of the defoliation next year should exceed 90 percent.

Eighty-four percent of the egg masses had only two rows of eggs; the masses were 6.9 mm. long and averaged 28.01 eggs per mass.

DISCUSSION AND SUMMARY

Over 1.6 million acres were defoliated by the spruce budworm this year in Region Four. There are actually three distinct and separate infestations. The Salmon River infestation is the largest with a total of 1.4 million areas. The Targhee National Forest infestation covers 177,000 acres and the Sawtooth National Forest infestation 41,000 acres. Epidemic populations have been present for at least the last three years on all three infestations. Acreage infested and severity of damage have increased each year. About one-third of the total infested area has been heavily defoliated for at least two years.

This year, for the first time, an egg mass survey was used to help predict next year's expected defoliation. Predictions were made using tables developed from studies conducted in other Regions. Before complete confidence can be placed in the use of the prediction tables, it must be determined if they are applicable to Region Four conditions. Comparison of biological data over the last few years indicates most of the Region Four budworm infestations are similar to those in Region Six with respect to populations and damage levels. Consequently, Carolin's prediction tables are favored.[1/] Defoliation will be measured next season to help determine the accuracy of predictions based on egg mass density.

Measurement of the number of eggs per mass and per mm. of length show our egg numbers per mm. fall between those found by Bean[1/] and Terrell.[3/] Except for the shorter egg masses, the number of eggs were a little closer to the number given by Terrell's formula of (length in mm.) X 7-9. All of the egg masses were of the two or three-row varieties. On the Salmon National Forest infestation nearly all of the egg masses had only two rows. However, on the Targhee National Forest there were two areas where more than 50 percent of the egg masses had three rows of eggs. Three-row egg masses averaged from one to three mm. longer than two-row egg masses.

It was quite evident that egg mass density per branch was very light on branches which has suffered three or more successive years of medium to heavy defoliation. In other words, lighter foliage indicated fewer egg masses.

1/ Ibid., p. 1064.

3/ Tom T. Terrell, Techniques of Spruce Budworm Surveys in the Northern Rocky Mountain Region, 14 pp., 1959 progress report. U. S. Dept. of Agriculture, Intermountain Forest and Range Experiment Station - July 1960.

Mass migration of adult moths occurred this year in the Salmon River country. It is quite possible that many new areas may now be infested, if these flights took place before the females laid their eggs. It is also possible that winds may have carried the adult moths away from susceptible timber and this, of course, could cause a sizeable reduction in egg population.

Noticeable spider mite damage was present on most of the branch samples collected on the Targhee National Forest. Spider mite eggs were numerous, and it appears the mites will be plentiful again next year.

Direct control action on all or part of the spruce budworm infrestations can be justified from the entomological viewpoint, provided biologically sound control boundaries are established.

Bodies of dead spruce budworm adults on shore of Terrace Lake, Salmon National Forest. (Terrace Lake lies about five air miles from nearest known infestation.

TARGHEE NATIONAL FOREST

SPRUCE BUDWORM